The status of breeding seabirds and waterbirds on the Eritrean Red Sea islands

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Le statut des oiseaux de mer et des oiseaux d'eau nicheurs sur les îles éritréennes de la Mer Rouge. Nous évaluons le statut actuel des oiseaux de mer et des oiseaux d'eau nicheurs sur les îles éritréennes de la Mer Rouge, qui sont toujours pour la plupart inhabitées et dont beaucoup n'avaient jamais été visitées par des ornithologues auparavant. En 2001–07 nous avons inventorié 325 îles (93% du total), dont 210 hébergeaient 21 espèces nicheuses d'oiseaux de mer et d'oiseaux d'eau. Nous avons compté environ 150.000 couples nicheurs et estimons le nombre total à environ 175.000 couples. Les espèces ou sous-espèces suivantes avaient des populations nicheuses d'importance internationale, les îles éritréennes hébergeant plus de 1% de la population régionale: Drome ardéole *Dromas ardeola* (>8.000 couples), Goéland à iris blanc *Larus leucophthalmus* (5.900 couples), Sterne voyageuse *Sterna bengalensis par* (63.000 couples), Sterne huppée *S. bergii velox* (2.200 couples), Sterne bridée *S. anaethetus fuligula* (30.000–35.000 couples), Sterne à joues blanches *S. repressa* (18,000 couples), Noddi brun *Anous stolidus plumbeigularis* (11.000 couples), Fou brun *Sula leucogaster plotus* (10.000 couples) et Spatule blanche *Platalea leucorodia archeri* (environ 300 couples). Le Cormoran de Socotra *Phalacrocorax nigrogularis*, auparavant connu de la Mer Rouge comme un visiteur rare, a été observé en grand nombre et est soupçonné de nicher sur les îles méridionales. À présent, les menaces principales pesant sur les oiseaux de mer nicheurs sont la collecte des ufs par des pêcheurs de concombres de mer (locaux et étrangers), et l'introduction occasionelle de chats. Nous confirmons que les îles éritréennes méritent le statut de Zone d'Importance pour la Conservation des Oiseaux (ZICO) et nous identifions 50 îles qui ont besoin de protection spéciale.

Summary. We assess the current status of breeding seabirds and waterbirds on the still mostly unpopulated Eritrean islands, many of which had never previously been visited by ornithologists. In 2001–07 we surveyed 325 islands (93% of the total), of which 210 were found to harbour 21 breeding species of seabirds and waterbirds. We counted *c.*150,000 breeding pairs and estimate the total number at *c.*175,000 pairs. The following species or subspecies were found to have internationally important breeding populations, as the Eritrean islands support more than 1% of the regional population: Crab Plover *Dromas ardeola* (>8,000 pairs), White-eyed Gull *Larus leucophthalmus* (5,900 pairs), Greater Crested Tern *S. bergii velox* (2,200 pairs), Lesser Crested Tern *Sterna bengalensis par* (63,000 pairs), Bridled Tern *S. anaethetus fuligula* (30,000–35,000 pairs), White-cheeked Tern *S. repressa* (18,000 pairs), Brown Noddy *Anous stolidus plumbeigularis* (11,000 pairs), Brown Booby *Sula leucogaster plotus* (10,000 pairs) and Eurasian Spoonbill *Platalea leucorodia archeri* (*c.*300 pairs). Socotra Cormorant *Phalacrocorax nigrogularis*, previously reported in the Red Sea only as a rare vagrant, was observed in large numbers and is suspected to breed in the southern islands. Currently, the main threats to breeding seabirds are egg collection by local and foreign sea cucumber fishermen, and the occasional introduction of cats. We confirm that the Eritrean islands deserve the status of Important Bird Area and we identify 50 islands in need of special protection.

The Red Sea and its islands are well known for the high diversity of marine organisms and avifauna, particularly seabirds and waterbirds, as revealed by the recent PERSGA surveys made by the Regional Organization for the Conservation of the Environment of the Red Sea & Gulf of Aden (PERSGA/GEF 2003), which included all of the Red Sea, except the Eritrean part and its 350 islands (MLWE 1999). Marine ornithological studies in the Eritrean Red Sea commenced in the

1800s, with the visits of Heuglin to the Dahlak Islands in 1857 and 1861 (von Heuglin 1861, 1867, 1873). In the 20th century ornithological studies were conducted by Salvadori (1954), Smith (1951, 1955, 1957), Clapham (1964), Tornielli (1964) and Urban (1969). Incidental comments were also published by the Israel Red Sea Expeditions (Oren 1962, Lewinson & Fishelson 1967). A long period of war between Ethiopia and Eritrea practically closed the islands to subsequent research (MLWE 1999), but the islands were already known to be important for birds restricted to the Sahara-Sindian biome, and probably for seabirds and waterbirds, leading to the area being designated as an Important Bird Area (Coulthard 2001). However, only a relatively few islands had been surveyed prior to the present surveys, conducted by the ornithological team of Eritrea's Coastal Marine and Islands Biodiversity (ECMIB) Project, and by G. De Marchi and G. Chiozzi during searches for Crab Plover *Dromas ardeola* colonies (De Marchi *et al.* 2006). Our study includes all waterbirds and seabirds and two raptors, Osprey *Pandion haliaetus* and Sooty Falcon *Falco concolor*. Specific objectives included: (1) assessing their current breeding status; (2) identifying the current threats they face and (3) selecting priority areas for their conservation.

Methods

Study area

Eritrean waters harbour more than 350 islands (Fig. 1). Some are very large, such as Dahlak Kebir (*c.*644 km^2), whereas some sandy and coralline islands are tiny. Most islands are low and almost flat relicts of large Pleistocene reef platforms (Angelucci *et al.* 1981, Merla *et al.* 1981), but *c.*25 are of volcanic origin and five a continental one. Climate is hot and humid, with daily temperatures of 35–40°C in June–September, whilst it is cooler in October–May (18–32°C). Rain falls mainly in December–February, but precipitation is local and irregular, ranging from 44 mm (in Assab) to 180–250 mm (in Massawa: Hemming 1961, Nastasi 1994). Tides are semi-diurnal and range between 50 and 120 cm (Edward 1987). Vegetation is sparse (Coulthard 2001). Black Rats *Rattus rattus* are found on many islands, especially the larger and vegetated ones. Cats, introduced by fishermen or sea cucumber harvesters to control the rats, were noted on a few islands. Only eight islands possess a resident human population, totaling *c.*3,000, mostly fishermen and goat herders. Permanent sea cucumber processing camps were noted on many islands. Additionally, there are small numbers of shell and shark fin collectors on some islands. Development is low and only 21 islands are open for tourists (Ministry of Tourism list), whilst there are very small Eritrean navy stations on a few islands.

Survey methods

Between January 2005 and October 2007, 15 ornithological surveys were undertaken by the ECMIB Project Bird Team, 11 in the summers (June–August) of 2005, 2006 and 2007, and the other four in the winters (October–February) of 2005 and 2006. Moreover, some additional islands were visited by G. De Marchi and G. Chiozzi between 2001 and 2007. Landsat ETM satellite images and Garmin GPS were used for navigation and position fixing.

The number of breeding pairs was determined by individually counting occupied nests, whenever possible, even for very large colonies. The number of nests in some of the largest colonies of Lesser Crested *Sterna bengalensis* and Greater

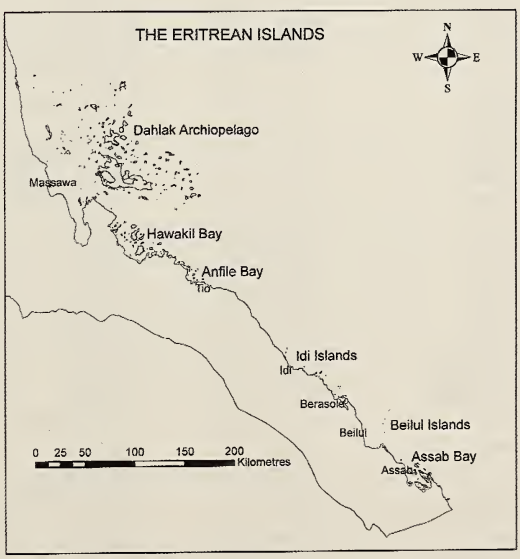

Figure 1. Map of Eritrean islands where the study of breeding seabirds and waterbirds was undertaken.

Carte des îles éritréennes où les oiseaux de mer et les oiseaux d'eau nicheurs ont été inventoriés.

Table 1. Important islands which support more than 1% of a biogeographical population (in bold: the island name, its important species, with the number of breeding birds in brackets) and the islands (roman) which support at least five different breeding species in significant numbers. Islands labelled NN (no name) are taken from a list of the Eritrean Ministry of Fisheries.

Tableau 1. Îles importantes qui hébergent plus de 1% d'une population biogéographique (en gras: le nom de l'île, ses espèces importantes, avec le nombre d'oiseaux nicheurs entre parenthèses) et les îles (en romain) qui hébergent au moins cinq espèces nicheuses différentes en nombre significatif. Les îles marquées NN (no name = sans nom) proviennent d'une liste du Ministère éritréen de la Pêche.

Species codes / Code des espèces: Red-billed Tropicbird *Phaethon aethereus* = RbT; Masked Booby *Sula dactylatra* = MB; Brown Booby *S. leucogaster* = BB; Green-backed Heron *Butorides striata* = GbH; Western Reef Heron *Egretta gularis* = WRH; Goliath Heron *Ardea goliath* = GH; Sacred Ibis *Threskiomis aethiopicus* = SI; Eurasian Spoonbill *Platalea leucorodia* = ES; Osprey *Pandion haliaetus* = O; Sooty Falcon *Falco concolor* = SF; Crab Plover *Dromas ardeola* = CP; Kentish Plover *Charadrius alexandrinus* = KP; Sooty Gull *Larus hemprichii* = SG; White-eyed Gull *L. leucophthalmus* = WeG; Caspian Tern *Sterna caspia* = CT; Greater Crested Tern *S. bergii* = GCT; Lesser Crested Tern *S. bengalensis* = LCT; White-cheeked Tern *S. repressa* = WcT; Bridled Tern *S. anaethetus* = BT; Brown Noddy *Anous stolidus* = BN.

Island	Coordinates	Area	Species breeding on the island
Abeilat	13.889N 41.974E	Idi Islands	O, SF, SG, **WeG (6,500)**, GCT, LCT
Abu Sherayu	16.068N 39.610E	Dahlak Archipelago	RbT, O, SF, WeG, WcT, BT
Adbara Kebir	15.999N 39.830E	Dahlak Archipelago	O, SG, **WeG (600)**, CT, **LCT (900)**, WcT, BT
Awali-Shaura	16.481N 39.669E	Dahlak Archipelago	O, SF, SG, WeG, CT, GCT, **LCT (7,000)**, WcT
Aucan	15.489N 40.759E	Dahlak Archipelago	**BB (2,400)**, SF, WcT
Cod Ali	13.877N 41.932E	Idi Islands	O, SF, SG, **WeG (3,200)**, **LCT (10,000)**
Dahara North	13.185N 42.575E	Assab Bay	WRH, **ES (100)**, O
Dahret	15.543N 39.344E	Dahlak Archipelago	O, CP, SG, CT, WcT, BT
Dalcus	15.541N 39.522E	Dahlak Archipelago	RbT, O, SF, SG, **WeG (1,600)**, CT
Delgus	12.983N 42.932E	Assab Bay	**ES (30)**, O, **CP (3,000)**, SG, WeG
Dohul Bahut	15.945N 39.535E	Dahlak Archipelago	WRH, ES, O, SG, WeG, CT, WcT, BT
Dhu-l-Kurush	15.459N 40.734E	Dahlak Archipelago	**BB (1,200)**, SF, SG, GCT, LCT, WcT, BT
Dur Ghella	15.775N 39.796E	Dahlak Archipelago	RbT, BB, O, SF, SG, **WeG (450)**
Entaasnu	16.332N 40.231E	Dahlak Archipelago	O, SF, SG, WeG, GCT, LCT, WcT, BT
Entaentor	16.131N 39.854E	Dahlak Archipelago	O, SF, SG, WeG, GCT, LCT **(6,000)**, BT
Enta-idell	16.125N 39.858E	Dahlak Archipelago	GH, O, SF, SG, WeG, CT, **GCT (250)**, **LCT (4,000)**, **WcT (6,000)**
Entesilla	16.504N 39.318E	Dahlak Archipelago	BB, O, SF, SG, WeG, **GCT (250)**, **LCT (2,500)**, WcT, BT, **BN (12,000)**
Fanaadir, NE	13.754N 42.163E	Barasole Islands	BB, BT, **BN (800)**
Flat	13.409N 42.551E	Beilul Islands	**BB (2,500)**, **LCT (5,000)**, BT, **BN (2,500)**
Galdina	15.049N 40.249E	Hawakil Bay	**CP (700)**, **LCT (2,500)**, WcT, BT
Gurna	12.974N 42.798E	Assab Bay	O, **BT (10,500)**
Harbi	13.355N 42.650E	Beilul Islands	**BB (1,500)**, MB, SG, BT, **BN (4,000)**
Isratu	16.200N 39.520E	Dahlak Archipelago	RbT, BB, O, SF, WcT
Laksu	15.209N 40.302E	Hawakil Bay	WRH, SF, SG, WeG, GCT, **LCT (4,000)**, WcT, BT
Madote	15.384N 39.457E	Dahlak Archipelago	O, CT, GCT, **LCT (2,000)**, WcT, BT
Mantola	14.441N 40.500E	Hawakil Bay	BB, WRH, **ES (95)**
Medecheri	15.423N 39.572E	Dahlak Archipelago	WRH, **ES (40)**, WeG,
Mojeidi	15.487N 40.861E	Dahlak Archipelago	BB, O, SF, KP, **LCT (12,000)**, WcT
Museri	15.489N 40.359E	Dahlak Archipelago	RbT, BB, O, SF, **CP (900)**
NN 043	14.985N 40.580E	Hawakil Bay	BB, WRH, GH, O, SF, SG, WeG, WcT, BT
NN 153	15.024N 40.374E	Hawakil Bay	O, **CP (700)**, WcT, BT
NN177	13.026N 42.892E	Assab Bay	**GCT (1,000)**, **LCT (17,000)**
NN 189	13.449N 42.566E	Beilul Islands	BB, SF, SG, WeG, GCT, **LCT (2,500)**, BT, **BN (1,000)**
NN 190	13.515N 42.613E	Beilul Islands	BB, MB, GbH, SG, SF
NN 198	15.168N 40.210E	Hawakil Bay	O, GCT, **LCT (6,000)**, WcT, BT
Om el Assela	12.934N 42.824E	Assab Bay	WRH, **ES (90)**, O, CP, SG, WeG, BT
Rakh Howtha	15.272N 40.102E	Hawakil Bay	RbT, GbH, WRH, GH, ES, O, SF, SG, WeG, WcT
Romiya	16.528N 40.042E	Dahlak Archipelago	O, **SF (60)**, **GCT (750)**, **LCT (4,000)**, WcT
Sadla	13.882N 41.939E	Idi Islands	BB, O, SF, SG, WeG, GCT, **LCT (1,400)**
Sayal	13.330N 42.567E	Beilul Islands	BB, BT, **BN (8,000)**
Sarad	15.819N 39.911E	Dahlak Archipelago	RbT, BB, O, SF, CP, SG, WeG
Scoglio Tauanich	15.081N 40.431E	Hawakil Bay	GbH, GH, **ES (60)**, O, SF, BT
Seil	14.840N 40.844E	Anfile Bay	RbT, **BB (5,000)**, GbH, O, SF, SG, WeG, **GCT (2,500)**, **LCT (18,000)**, BT
Sheikh el Abu	16.032N 39.437E	Dahlak Archipelago	O, SG, CT, **GCT (700)**, **LCT (12,000)**, WcT, BT
Umal Bager	12.868N 42.789E	Assab Bay	GbH, WRH, SI, ES, O, **CP (1,200)**, SG, WeG, GCT, LCT, WcT, BT
Umel Beger	12.982N 42.770E	Assab Bay	GbH, **ES (30)**, O, SG, WeG, BT
Umm en Nayim	15.068N 40.466E	Hawakil Bay	BB, GbH, O, SF, **CP (2,200)**, SG
Umm Namus	15.383N 40.049E	Hawakil Bay	GH, O, SG, WeG, GCT, LCT, WcT
Urubia	12.988N 42.836E	Assab Bay	ES, O, **CP (1,900)**, SG, WeG
Zauber	15.637N 40.785E	Dahlak Archipelago	O, **GCT (500)**, **LCT (2,600)**, WcT, BT

Crested Terns *S. bergii* were estimated by measuring first the density of nests within several 1 m × 1 m squares placed evenly throughout the colony and multiplying for the total area of the colony. Bridled Tern *S. anaethetus* nests are very difficult and time-consuming to locate, as they are generally concealed under low vegetation or in rock crevices. For this species, the number of adults was estimated by using flushing counts (Bibby *et al.* 1992). We roughly estimated the total number of breeding pairs by multiplying for 2/3, as in Bullock & Gomersall (1981). Taxonomy follows Wetlands International (2006), which gives also the 1% level of every biogeographical population.

Results

Three hundred and twenty-five islands (93% of the total) were visited and 21 species of breeding seabirds and waterbirds were recorded on 210 of them, with densities of 1–12 breeding species per island. We counted *c.*150,000 breeding pairs, but as some islands were not surveyed and others only in summer or in winter, and some nests might have been missed, we estimate that the actual number may be *c.*175,000 pairs.

Red-billed Tropicbird *Phaethon aethereus indicus*
One or two individuals were occasionally seen at sea. This species nests solitarily on cliffs, in caves or in holes perpendicular to the cliff. Breeding in the Dahlak Archipelago has been recorded in March (Salvadori 1954), June–July (Heuglin 1859), and August (Clapham 1962). In total we found 16 breeding pairs on 12 islands in both summer and winter. However, given the inaccessibility of their nests, the real number is certainly higher.

Masked Booby *Sula dactylatra melanops*
Considered a rare resident in the Red Sea, with *c.*48 breeding pairs on the Abu Ali Islands in Yemen (PERSGA/GEF 2003). In July 2007, we recorded 25 breeding pairs on three of the Beilul Islands within colonies of Brown Booby *Sula leucogaster* and Brown Noddy *Anous stolidus*. The breeding season is probably similar to that of the next species.

Brown Booby *Sula leucogaster plotus*
Abundant and breeds in scattered groups or semi-colonies on open bare ground or on cliffs. Clapham (1964) found 100 pairs on Isratu and 20 on Wusta (Dahlak Islands) in August 1956. We recorded 10,000 breeding pairs on 46 islands. The nesting season varies between the northern and southern islands. In the north breeding commences in late summer (August) and lasts until December. In the south, on the Beilul Islands, we observed both eggs and chicks in July 2006, suggesting that breeding starts in spring and continues well into summer. The highest number of breeding Brown Boobies in the Red Sea was recorded in Yemen, with 13,243 breeding pairs (PERSGA/GEF 2003).

Socotra Cormorant *Phalacrocorax nigrogularis*
Endemic to the continental shelf from the Arabian Gulf to the Gulf of Aden and considered Vulnerable (BirdLife International 2007). Previously, there were only two records of single individuals from Eritrea and the Red Sea, one near Assab in 1889–90 (Moltoni 1942) and one at the Eritrea–Djibouti border in 1987 (Welch *et al.* 1992). We found the species year-round at sea around Idi, Tio and Marsa Fatima. The highest counts were 3,000–4,000 in Howakil Bay in January 2004, 1,100 in November 2005 near Idi, more than 1,500 in July 2006 near Idi, and *c.*1,500 in Anfile Bay on July 2007. Local fishermen know the species, which they call *subbahi*, and report that the cormorants breed on the islands in the late summer.

Pink-backed Pelican *Pelecanus rufescens*
Common on the coasts and islands of Eritrea. Nesting was observed atop mangroves (*Avicenna marina*). We recorded 235 breeding pairs on nine islands. In the north, breeding starts in October and continues well into February, whereas in the south it lasts until July. Newton & Symens (1996) recorded breeding in the southern Saudi Arabian Red Sea, with major colonies in the Farasan Archipelago.

Green-backed Heron *Butorides striata brevipes*
One or two individuals usually present on islands with coral cliff and mangroves. A solitary breeder, nesting in holes and in crevices of coral cliffs, in mangrove and other tall vegetation. We recorded 32 breeding pairs on 20 islands, but probably many more pairs breed. Breeds in winter and early

summer. In Yemen, 65 nests were recorded on the Red Sea islands (PERSGA/GEF 2003).

Western Reef Heron *Egretta garzetta schistacea*
Two to four individuals were usually seen on the majority of the islands visited. Nests were found atop mangroves, in dense shrubs and tall halophytes. In total we recorded 150 breeding pairs on 20 islands. Breeding starts in March and lasts until July. The largest known colony on the Red Sea coast was recorded in Egypt, with 40–60 pairs in the mangrove of Manqata, north of Nabq (Goodman & Meininger 1989).

Goliath Heron *Ardea goliath*
One or two individuals were usually seen in shallow waters and coral cliffs of many islands. A solitary breeder. Nests were observed on mangrove trees, atop shrubs, on the ground on coral outcrops or amongst shrubby vegetation. We recorded 21 breeding pairs on 16 islands, a total that will almost certainly increase if the entire Eritrean islands are surveyed both in winter and summer. The breeding season is summer and winter. In Yemen ten pairs have been recorded (PERSGA/GEF 2003).

Abdim's Stork *Ciconia abdimii*
Usually seen in Eritrea's coastal towns and villages. Nests were found on Durgella Island in March 1953 (Salvadori 1954). We recorded three colonies on Dissie Island, one on nearby Seil Island close to the Buri Peninsula, and one on Andebar Island in the Dahlak Islands. In total, we found 63 breeding pairs. Breeding commences in October and continues well into March, whilst in the highlands the species breeds during summer.

Sacred Ibis *Threskiornis aethiopicus*
Usually seen foraging on mudflats in coastal cities. Large numbers were recorded breeding on the small island of Haramous and on a shipwreck south of Djibouti (PERSGA/GEF 2003). We recorded 52 breeding pairs in mangrove on Sheikh Said Island, near Massawa. Two pairs were seen on empty nests at Emal Bager Island (Assab Bay), within colonies of Eurasian Spoonbill *Platalea leucorodia* and Western Reef Heron *Egretta garzetta schistacea*. Breeds in winter.

Eurasian Spoonbill *Platalea leucorodia archeri*
Usually found on islands with mangrove forest. Nests were observed atop mangrove, dense shrubs and tall halophytes as well as on coral outcrops. On many occasions, Eurasian Spoonbills were observed breeding in association with Western Reef Heron *Egretta garzetta schistacea*. We recorded 284 breeding pairs on 18 islands. Breeding starts in March and lasts until July. The estimated breeding population of *P. leucorodia* in Sudan ranges from 200 to 500 pairs, whilst in Saudi Arabia a total of 22 colonies supports 103 pairs (PERSGA/GEF 2003).

Osprey *Pandion haliaetus*
Recorded on the majority of islands visited during our summer and winter surveys. A solitary breeder. Ospreys build a massive nest of twigs, dried sponges and seaweed, pieces of vegetation and various other flotsam. Nesting is usually on elevated ground and atop hills, cliffs and lighthouses. Clapham (1964) recorded more than 50 birds on 15 islands in the Dahlak Archipelago. We found 92 active nests on 57 islands during our winter surveys and 132 pairs on 86 additional islands during the summer surveys, bringing the estimated total breeding population to more than 220 pairs. Breeding occurs from October until March.

Sooty Falcon *Falco concolor*
This species appears in April or May on many coralline cliff islands in Eritrea. It nests in holes or crevices on coral cliffs and occasionally at the base of mangroves and *Euphorbia*. We recorded 230 breeding pairs on 90 islands, with the majority on the Dahlak Archipelago; Romiya Island hosts 20 breeding pairs. Breeding starts in late June and lasts until early October.

Crab Plover *Dromas ardeola*
Discovered to breed underground by Theodor Von Heuglin (1861, 1867, 1873), in 1858 on the Dahlak Islands. Excavates a burrow in flat or gently sloping sandbanks, often vegetated with low halophytes. A recent study in the central Eritrean Red Sea confirmed the existence of ten active colonies (De Marchi *et al.* 2006). During our study 21 active breeding colonies were found on 21 different islands. In total 8,661 fresh burrows were counted. The largest colony, with 1,600 bur-

rows, was on Delgus Island (Assab Bay). The breeding population of Crab Plover in the Eritrean Red Sea is thus probably the largest in the world. Breeding starts in early May and lasts until August or early September. The world population is estimated at 60,000–80,000 (Wetlands International 2006). Recent surveys in the Red Sea have revealed that this region supports probably 3,000–3,500 breeding pairs, excluding Eritrea (PERSGA/GEF 2003).

Kentish Plover *Charadrius alexandrinus*
Two to three individuals were recorded on many of the islands visited. During our study four nests were found on three islands. The broken-wing display was observed on an additional four islands. In total, we recorded 13 breeding pairs on seven islands. The difficulty in finding this species' nest means that this is almost certainly an underestimate. The breeding season is mainly from June to July. On the Yemeni Red Sea islands 40 pairs were recorded breeding in July 2002 (PERSGA/GEF 2003).

Sooty Gull *Larus hemprichii*
Low to moderate numbers were recorded on all islands visited. The species breeds solitarily or in loose colonies, and its breeding biology is similar to that of White-eyed Gull *L. leucophthalmus*. In total, we recorded 1,067 breeding pairs on 67 islands. Breeding starts in June and continues until August.

White-eyed Gull *Larus leucophthalmus*
Endemic to the Red Sea and Gulf of Aden and listed as Near Threatened (BirdLife International 2007), White-eyed Gull is a colonial or semi-colonial breeder, nesting below dense bushes, shrubs and halophytes, on open ground and occasionally in coral caves or in crevices. We recorded 5,900 breeding pairs on 49 islands, with Abeilat Island, near Idi, hosting *c.*3,000 pairs. Breeding commences in June and continues until August. The global population has been estimated at 37,000–44,000 (Wetlands International 2006). In the Red Sea and Gulf of Aden region, excluding Eritrea, 12,000–13,000 pairs are estimated to breed (PERSGA/GEF 2003).

Caspian Tern *Sterna caspia*
Small numbers were seen on many of the islands. Caspian Terns breed either alone or in small, loose colonies, numbering up to ten pairs, on bare sand, usually close to the beach. We found 103 breeding pairs on 45 islands of the Dahlak Archipelago and Hawakil Bay during our winter surveys. Probably many more breed there, as we surveyed only some of the islands at this season, when the species breeds. In the Saudi Arabian Red Sea, there are reports of 100–200 breeding pairs (PERSGA/GEF 2003).

Greater Crested Tern *Sterna bergii velox*
Small numbers were seen on many islands, where they nest in association with Lesser Crested Tern *S. bengalensis*. We recorded 2,200 breeding pairs on 26 islands.

Lesser Crested Tern *Sterna bengalensis par*
Common on many visited islands, forming large, dense colonies on bare sand close to the sea. We recorded 63,000 pairs in 40 colonies on 32 islands. The largest single colony was at Anfile Bay, Seil Island, with 8,500 breeding pairs, which is probably the largest colony in the Red Sea. Clapham (1964) found a large colony containing several thousand chicks on Seil Wusta, on 30 August 1962. Nests in summer. The total number of breeding pairs in the Red Sea is estimated at 13,000–15,000, excluding Eritrea (PERSGA/GEF 2003).

White-cheeked Tern *Sterna repressa*
Breeds widely on the Eritrean islands. Colonies were found on bare ground. Clapham (1964) observed flocks containing a large proportion of immatures in August 1962. We recorded 18,000 breeding pairs on 69 islands. Breeds in summer. The total number of breeding pairs in the Red Sea, excluding Eritrea, was estimated at 27,000–30,000 (PERSGA/GEF 2003).

Bridled Tern *Sterna anaethetus fuligula*
Breeds widely on the Eritrean islands. It nests below vegetation, in caves, in crevices and, surprisingly, in abandoned Crab Plover *Dromas ardeola* burrows. A breeding colony was found on Seil Adasi Island, in 1962, by Clapham (1964). In the Eritrean Red Sea we estimated 30,000–35,000

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breeding pairs on 66 islands. Gurna, a very small island in Assab Bay, held 5,000 pairs. Breeding commences in May and continues until August. In the Eastern Red Sea 130,000 breeding pairs were recorded (PERSGA/GEF 2003).

Saunders's Tern *Sterna saundersi*
In the Red Sea, breeds in Saudi Arabia, Yemen and along the Somali coast (PERSGA/GEF 2003). In March 2005, we observed more than 130 frenzied pairs landing on open ground and amongst low halophytes on Fatima Island (Assab Bay). In July 2005 we observed more than 70 juveniles in the same place, whilst fishermen claim to have seen this species breeding on Fatima Island. Twenty-four individuals were noted apparently breeding on Norah Island in May 2005. Breeding probably commences in April.

Brown Noddy *Anous stolidus plumbeigularis*
Common on the Beilul Islands and along the northern Eritrean coast. Nests in caves and crevices of rocky islands and atop tall halophytes. Smith (1951) observed hundreds in June 1940 on the Beilul Islands. We recorded breeding on five of the Beilul Islands and on Entesila Island in the Dahlak Archipelago, with an estimated 11,000 pairs. Breeds in summer. The total number estimated in the Red Sea and Gulf of Aden is >30,000 breeding pairs.

Discussion

Our surveys highlight that the Dahlak Archipelago and Offshore Islands IBA is important not only for the significant component of species restricted to the Sahara-Sindian biome, under criteria A3 (Coulthard 2001), but also under categories A1 and A4i, A4ii and A4iii.

Under category A1 White-eyed Gull is considered Near Threatened and is endemic to the Red Sea and Gulf of Aden. Its global population has been calculated, outside Eritrea, to be *c.*37,000–44,000 birds (Wetlands International 2006). We found *c.*6,000 breeding pairs, or almost one-third of the world's breeding population. Another species of global concern, the threatened Socotra Cormorant was considered a rare vagrant to the Red Sea, with only two published reports of single birds (Moltoni 1942, Welch *et al.* 1992), but we discovered that several thousand individuals are present in Eritrean waters, possibly year-round, and breeding is suspected. Additional surveys are needed to fully elucidate the status of this species.

Moreover, the IBA is important under category A4i because during the breeding season it holds on a regular basis more than 1% of the biogeographic population of the following species: Lesser Crested Tern *Sterna bengalensis par* (more than 70% of the world population), Brown Noddy *Anous stolidus plumbeigularis* (*c.*25%), Crab Plover *Dromas ardeola* (at least 20%), Eurasian Spoonbill *Platalea leucorodia archeri* (18%), Brown Booby *Sula leucogaster plotus* (almost 10% of the world population), Greater Crested Tern *Sterna bergii velox* (18%), White-cheeked Tern *S. repressa* (6%) and Bridled Tern *S. anaethetus fuligula* (3.0–3.5%). Under category A4ii (more than 1% of the population of a congregatory seabird) the area is important for the high number of breeding Brown Boobies. Under category A4iii the IBA is important because year-round it supports more than 20,000 waterbirds; we recorded more than 330,000 waterbirds and more than 10,000 pairs of seabirds.

Captions to photos on opposite page

Figure 2. Adult Brown Noddy *Anous stolidus* with chick, on the Beilul Islands (D. Semere)

Noddi brun *Anous stolidus*, adulte avec oisillon, îles Beilul (D. Semere)

Figure 3. Juvenile Socotra Cormorant *Phalacrocorax nigrogularis*, Idi, Danakil coast (D. Semere)

Cormoran de Socotra *Phalacrocorax nigrogularis* juvénile, Idi, côte Danakil (D. Semere)

Figure 4. In a Crab Plover *Dromas ardeola* colony, Dahret, Dahlak Islands (G. De Marchi)

Dans une colonie de Dromes ardéoles *Dromas ardeola*, Dahret, îles Dahlak (G. De Marchi)

Figure 5. Breeding colony of Lesser Crested Terns *Sterna bengalensis*, Dahret, Dahlak Islands (G. De Marchi)

Colonie de Sternes voyageuses *Sterna bengalensis*, Dahret, îles Dahlak (G. De Marchi)

Figure 6. Adult Sooty Falcon *Falco concolor* with chick, Seil Island, Buri Peninsula (G. De Marchi)

Faucon concolore *Falco concolor*, adulte avec oisillon, île de Seil, péninsule de Buri (G. De Marchi)

Figure 7. Adult Eurasian Spoonbill *Platalea leucorodia* with chick, Seil Island, Buri Peninsula (G. De Marchi)

Spatule blanche *Platalea leucorodia*, adulte avec oisillon, île de Seil, péninsule de Buri (G. De Marchi)

Forty islands meet individually the 1% criteria and three (Entesila, the Dahlak NN177 in Assab Bay and Seil in Anfile Bay) support more than 20,000 breeding waterbirds (Table 1). Ten additional islands support many breeding species and are therefore of particular value (Table 1). We consider that all of these 50 islands are in need of a special protection and the status of their breeding birds should be monitored regularly because of the presence of certain threats.

Black Rats *Rattus rattus* were observed on many islands (De Marchi *et al.* 2006; present surveys) and appear to affect colonial terns. Cats, introduced temporarily by local fishermen to control the rats, were seen on four uninhabited islands (pers. obs.) and could also represent a threat to larger bird species. The effect of rats and cats is potentially as severe in Eritrea as in other regions of the world (Atkinson 1984, Moors & Atkinson 1984, PERSGA/GEF 2003). Their introduction on the islands should be avoided and they should be eradicated where present. In addition, the introduction of grazing mammals, such as camels and goats, can disturb or destroy the nests or even entire colonies of ground-breeding birds.

However, the major threats for breeding seabirds on the islands come from direct human interference. At present many Eritrean islands support camps of local and foreign sea cucumber and shell collectors, fishermen and also navy personnel. They regularly collect eggs for consumption, affecting in particular Lesser Crested, Greater Crested and White-cheeked Terns, and Crab Plover. Moreover, they have cleared some areas of halophytes (affecting in particular nesting of Bridled Tern), to construct camps and racks for drying cooked sea cucumbers, and have cut mangrove for firewood and windbreaks. We propose that egg collection should be banned on all islands, as well as camping on those islands harbouring the most important breeding colonies of seabirds and waterbirds.

Overall, the threat represented by tourism appears low at present, as only 21 islands are open to tourists and only three of the important islands (Dahret, Madote and Durgella) are frequently visited by them. However, if tourism develops, uncontrolled visitors could have a much more considerable impact on breeding birds, as elsewhere in the world (Fowler 1999, Yorio *et al.* 2001). Therefore, we propose that the important breeding islands should be closed to tourism, at least during the main breeding season, or visited only under the supervision of an accredited guide.

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